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(54) **OBSERVATION AND/OR FIRING SYSTEM**

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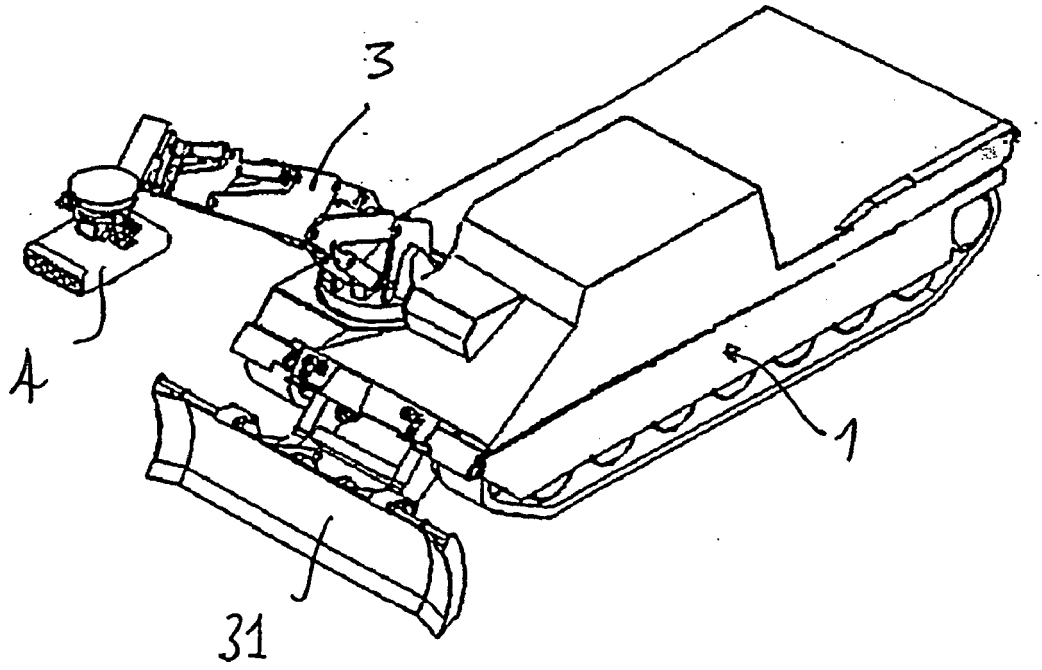
(57) **ABSTRACT**

The invention relates to an observation and/or firing system intended for an observer housed in a vehicle **1**, wherein the vehicle **1** is equipped with elevation means **3** for the observation means **4**, said means **4** being supported by a supporting structure, said elevation means **3** being equipped with an interface **19** to provide a power supply and communications with the observation means **4.**

The observation means **4** are constituted by a cupola adapted to the supporting structure and able to be removed from it. The cupola **4** is a component of the usable supporting structure which can be a vehicle.



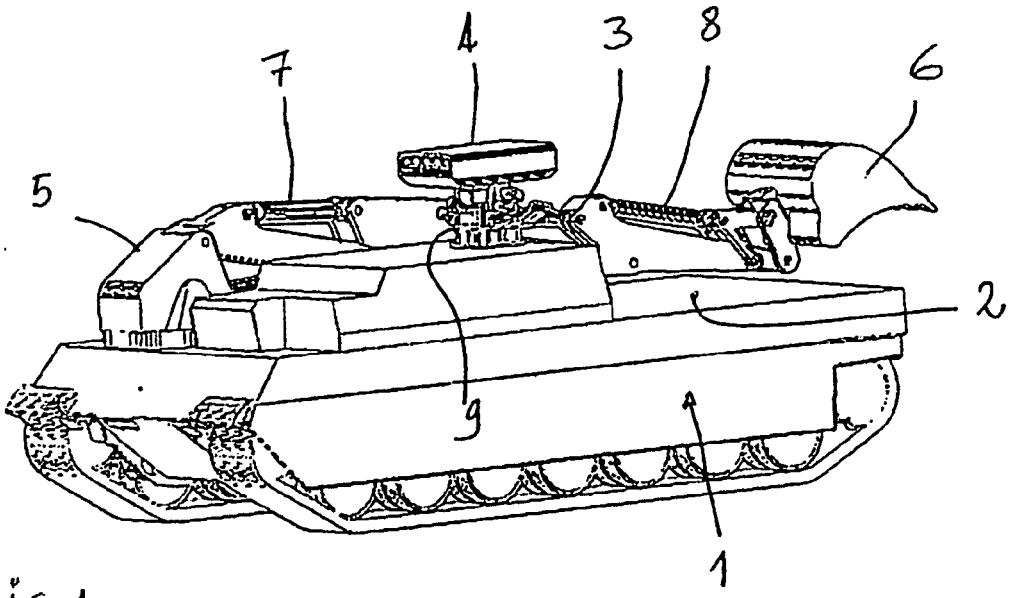


FIG.1

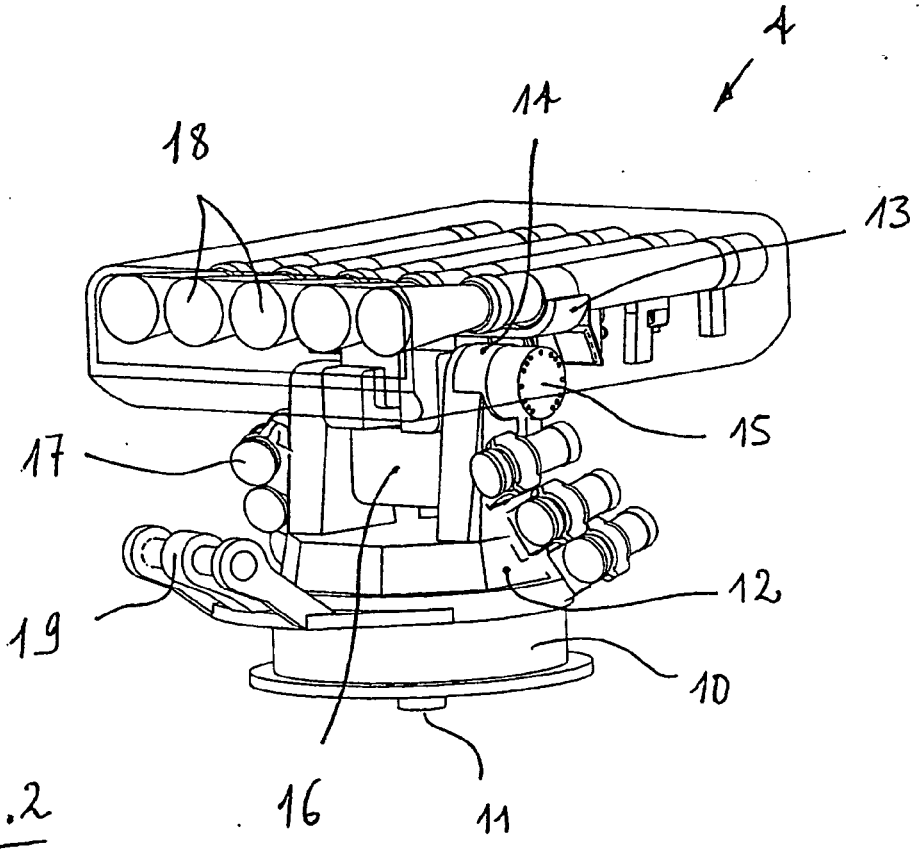


FIG.2

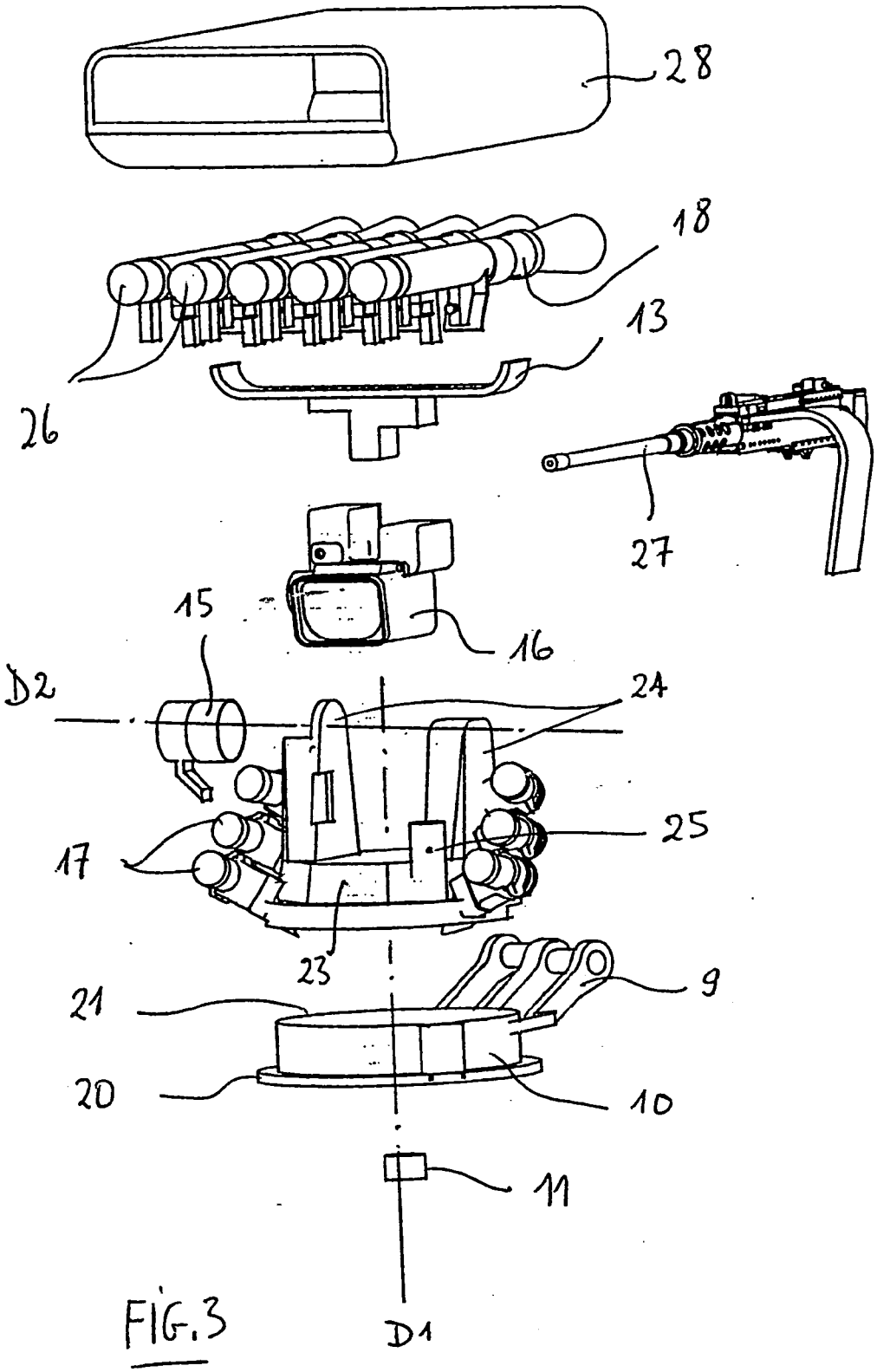


FIG.3

FIG.4

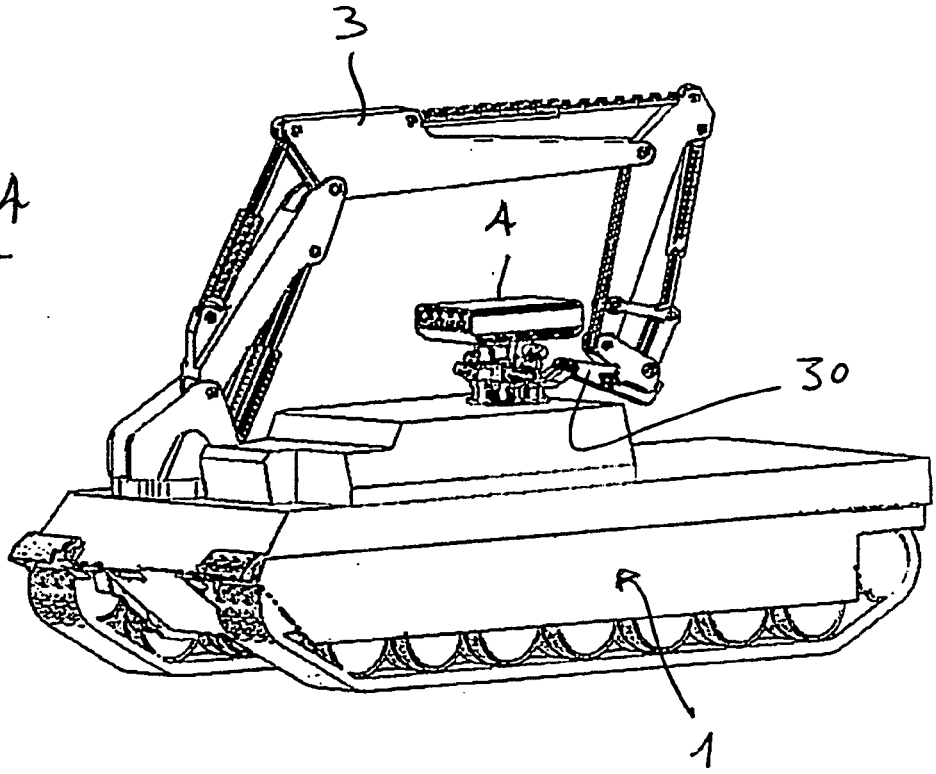
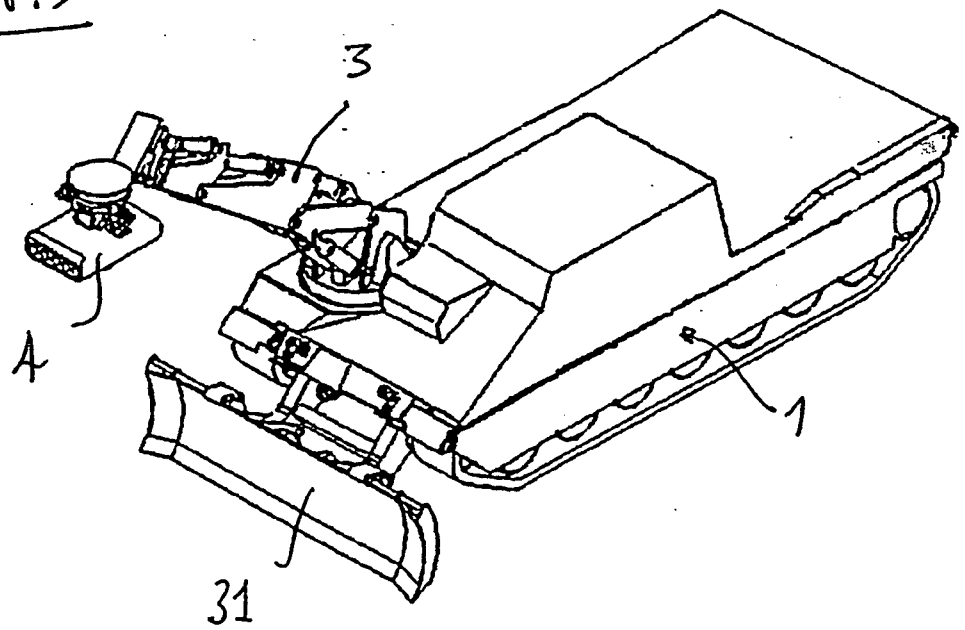


FIG.5



OBSERVATION AND/OR FIRING SYSTEM

[0001] The technical scope of the present invention is that of observation systems.

[0002] Observation and/or firing systems are generally mounted on the chassis of a vehicle and placed such that the vehicle must reveal itself to the observation or firing target so as to carry out its mission, in particular over compartment areas such as urban or wooded areas. Because of this, the target may take cover, make its escape or counter-attack. Once revealed to its target, the vehicle is vulnerable to aggressive action from this target.

[0003] Present day observation and/or firing systems mounted on a hinged arm or telescopic mast (or a combination of the two) use a support (the mast or the arm) whose function is merely to bring the observation and/or firing system into its operative position whilst keeping the vehicle hidden from the observation or firing target behind high ground, an obstacle or construction. Certain hinged arms mounted on vehicles intended for earth works allow different tools to be quickly mounted onto them without requiring manual intervention.

[0004] These interfaces allow the mechanical assembly of the tools as well as their power supply. Known deployment systems are dedicated to the observation system. It is not possible for the deployment means to be converted to another use and it is not possible to separate the observation means from the deployment means.

[0005] However, vehicles equipped with observation systems are made to carry out multiple missions and the rigidity of the mast equipped with its observation means constitutes a handicap. It is preferable, for example, for the elevation means to be able to be used for elevation, ground clearance, etc. By fitting them with the appropriate tooling.

[0006] The aim of the present invention is to allow elevation means carried by a vehicle and observation means to multitask by providing an appropriate interface on the elevation means allowing a link with any type of observation system, and an appropriate interface on the observation means allowing their connection to the elevation means or to a supporting structure.

[0007] Another aim of the invention is to allow the use of the elevation means of a vehicle with observation means carried by any type of supporting structure, for example by the vehicle itself.

[0008] Another aim of the invention is to produce multitask vehicles intended to fulfill not only observation and/or firing missions, but also earth working operations or handling or lifting operations for loads and/or persons.

[0009] The invention thus relates to an observation and/or firing system intended for an observer housed in a vehicle, wherein the vehicle is equipped with elevation means and observation means, said means being supported by a supporting structure, said elevation means being equipped with an interface to provide a power supply and communications with the observation means.

[0010] According to one characteristic of the invention, the observation means are constituted by a cupola adapted to the supporting structure and able to be removed from it.

[0011] According to another characteristic of the invention, the cupola is a component of the usable supporting structure, said supporting structure being a vehicle.

[0012] Advantageously, the elevation means are constituted by the maneuvering arm of the vehicle.

[0013] According to one characteristic, the cupola is equipped with control means activated by the observer when the cupola is attached to the elevation means or to the vehicle.

[0014] According to yet another characteristic, the cupola is equipped with sensors to measure the distance or identify the vehicle or targets.

[0015] Advantageously, the sensors are cameras that can be of the day, low level lighting, thermal infrared, light intensifying type, radars, optical or laser range finders, imaging systems, pointed optics detectors or position finders.

[0016] According to one characteristic, the cupola is equipped with offensive devices intended to neutralize, destroy or blind a target.

[0017] Advantageously, the offensive devices are constituted by grenade launchers, automatic weapons, cannons or mortars, missile launchers or lasers.

[0018] According to one advantageous embodiment of the invention, the observation means comprise a base able to be adapted onto the supporting structure and onto the elevation means, a first cradle able to move along a first axis (D1) with respect to the supporting structure under the action of motor means, a second cradle able to move along a second axis (D2) under the action of a motor with respect to the first cradle, and interfaces to provide power and communications between the structure and the base, the first and second cradle.

[0019] According to yet another advantageous embodiment, the vehicle is equipped with inspection means for the observation means from the driver's cabin, reception means for the signals transmitted by the observation means and image display means.

[0020] According to one characteristic, the offensive devices and the observation means are fastened to the second cradle.

[0021] Advantageously, the elevation means, the motor means and the observation means are provided with electrical, hydraulic or pneumatic power.

[0022] A first advantage of the system according to the invention lies in the modular concept of the observation system since the elevation means may be fitted with any type of cupola. This particularity is important in that the destroyed observation means may be discarded and replaced by other means taken from another supporting structure.

[0023] Another advantage lies in the resulting versatility of the elevation means. Indeed, since the arm is fitted with a multitask interface, different systems may be attached without modifying the elevation function.

[0024] Other characteristics, particulars and advantages of the invention will become more apparent from the description given hereafter by way of illustration and in reference to the appended drawings, in which:

[0025] **FIG. 1** is a view of a vehicle equipped with observation means,

[0026] **FIG. 2** is a perspective view of the cupola,

[0027] **FIG. 3** is an exploded view of the cupola,

[0028] **FIG. 4** shows the gripping phase of the cupola, and

[0029] **FIG. 5** shows the cupola in the operational phase.

[0030] **FIG. 1** shows a perspective view of a vehicle **1**, of the armored, tracked type for example, driven and crewed by operators, whose roof **2** supports means constituted by a manipulator arm **3** and a cupola **4**. The vehicle thus constitutes a supporting structure for the cupola **4**. The arm **3** is hinged with respect to the roof by means of a base **5** and has an excavator **6** at its free end. The arm is activated in elevation by jacks **7** and **8** and is controlled by the operators inside the vehicle and this in a fully classical manner and the position of use is that decided upon by the operators. The cupola **4** is connected to the vehicle **1** by a connecting interface **9** that will be described more fully hereafter. This interface **9** allows the operators to use all or part of the functions of the cupola. The cupola **4** integrates observation and/or firing means and this cupola may be fitted to the arm as will be explained after. Naturally, the cupola **4** also comprises gripping means intended to co-operate with the manipulator arm thereby constituting elevation means. The excavator **6** must be separated in this case from the arm so as to co-operate with the cupola.

[0031] It goes without saying that the manipulator arm **3** already equips the supporting vehicle **1**. Any vehicle or support may advantageously be equipped with a dedicated manipulator arm.

[0032] The arm **3** or elevation means may be constituted by a telescopic mast or hinged arm or else by a combination of a hinged arm and a telescopic mast. These elevation means **3** may be equipped with different interfaces to support the cupola **4**, the excavator or any other element. It incorporates, in addition, connection means to provide the control power, electrical for example, and to ensure the controls from the vehicle to the cupola and the transfer of data collected by the observation means.

[0033] The chassis of the supporting vehicle **1** naturally incorporates assembly, power supply and control signal interfaces for the cupola to which it is fixed.

[0034] The cupola **4** according to the invention is intended to ensure observation and/or firing functions.

[0035] **FIG. 2** shows a perspective view of the cupola **4** equipped with observation, defense and attack means according to the invention. This cupola **4** comprises a base structure **10** or interface that can be adapted onto the support, the vehicle **1** for example. This structure **10** is made integral in a removable manner to the support by any means and is fitted with an organ **11** allowing communication with the vehicle if the support is a vehicle. This structure **10** is topped by a first cradle **12** able to rotate with respect to the structure and allowing the cupola to be able to revolve by 360° in a manner qualified as rotation in traverse. This first cradle is topped by a second cradle **13** fixed to it by a shaft **14** placed substantially in the plane of the figure and activated in rotation by a motor **15**. This second rotation is qualified as rotation in elevation. The rotation of the second cradle **13** is thus carried out following an orthogonal axis to the traverse rotation axis of the first cradle **22**. These two rotations allow the cupola **4** to have a sufficient field of observation.

[0036] For the purposes of observation, the cupola **4** incorporates means **16** fixed to the second cradle **13** and comprising sensors allowing an operator to know his environment, estimate distance, identify targets, identify vehicles, devices or friendly or hostile persons. These sensors are, for example, day cameras or low level lighting cameras, thermal infrared cameras, light intensifying cameras, cameras operating in the ultraviolet range, radars, optical range finders, laser range finders, combat identification devices, millimetric wave imaging systems, laser imaging systems, pointed optics detectors, laser spot detectors, laser or radar alert detectors, position finders or any combination of these means. We can see that the cupola may be fitted with a variety of means depending on the mission to be carried out and the requirements of the perators.

[0037] Smoke bomb launchers **17** may be provided on the cupola **4**, for example at the first cradle **12**. These smoke bomb launchers are intended to create a cloud of smoke to mask the vehicle or operators on the terrain.

[0038] The cupola **4** may also incorporate, at its second cradle **13**, offensive devices **18** intended to destroy, neutralize, incapacitate, or blind a target. These devices may be grenade launchers, rifles, small or medium calibre automatic weapons, heavy machine guns, rocket launchers, demolition charge launchers, cannons or mortars, pointed optics or fire control scramblers, electronic and/or electro-optical counter measures, or any combination of such devices.

[0039] Naturally, the cupola **4** still incorporates means to orient the sensors and the offensive devices in the direction required by the operator in the vehicle. These means are constituted by the motor **15** to orient the second cradle **13** in traverse and another motor not shown in this figure to orient the first cradle **12** in elevation.

[0040] In the figure, we see that the cupola **4** is equipped with a mechanical and energetic interface **19** co-operating with the arm **3**. The mechanical interface allows a rigid link between the arm and the cupola and the energetic interface allows a power supply between the vehicle's controls and the movements of the cupola and the transfer of control signals.

[0041] It goes without saying that the movements or positions of the cupola are controlled by the operator in the vehicle **1** to thus display the signals transmitted by the sensors mounted on the cupola and to control the offensive devices.

[0042] The observation and/or firing cupola **4** may be used from the support vehicle chassis in a fixed classical position. The elevation means **3** may in this case be used for earth works, handling or lifting of loads or people. In this configuration, the cupola **4** is powered, either electrically, pneumatically or hydraulically, directly from the chassis via a specific link. The control signals pass from or to the vehicle to or from the cupola via links. The characteristics of said links (type, output, support) are adapted to the type of signal to be transmitted. The operator has a set of means to allow him to control the movements of the cupola, to control the sensors and visualize the data and to control the weapons or

offensive devices mounted on the cupola. The operator uses sensors on board the chassis and/or on the cupola to detect, acquire, identify, recognize, measure, and find the range of the targets. Scanning the environment of the vehicle using sensors is carried out by the movements of the cupola. The operator selects a target from among those previously detected, acquired, identified, recognized, measured or for which the range has been found and aims at it using the appropriate sensor by using the movements of the cupola. He then uses the weapons or other offensive devices of the cupola to destroy, neutralize, incapacitate, or blind the selected target by orienting the line of fire of the weapons or offensive devices by the movements of the cupola.

[0043] Once mounted on the elevation means, the cupola **4** allows the observation of and/or firing at targets whilst keeping the vehicle from being spotted and protecting it for any possible aggressive actions. This cupola is used as a remotely operated organ whose position in space may be at a distance from the supporting vehicle. The sensors and the offensive devices may point towards an objective or a target without the chassis being able to be seen by the objective or the target. The power required to operate the cupola is transmitted by the arm or the mast via a specific link, said arm being supplied with energy from the vehicle. The control signals are transmitted from (or to) the chassis to (or from) the cupola via links carried by the arm or the mast. The characteristics of the links are adapted to the type of signal to be transmitted. The operator of the system has a set of means allowing him to control the movements of the cupola, control the sensors, display the data and control the weapons or other offensive devices. The movement control means of the arm or mast are used in addition to bring the cupola into position in space with respect to the vehicle. The operator uses the sensors on board the chassis and/or on the cupola to detect, acquire, identify, recognize, measure and find the range of the targets. Scanning the environment of the vehicle using sensors is carried out by the movements of the cupola and/or the movements of the arm or mast. The operator selects a target from among those previously detected, acquired, identified, recognized, measured or for which the range has been found and aims at it using the appropriate sensor by using the movements of the cupola and/or the movements of the arm and/or mast. He then uses the weapons or other offensive devices of the cupola to destroy, neutralize, incapacitate, or blind the selected target by orienting the line of fire of the weapons or offensive devices by the movements of the cupola and/or the movements of the arm or mast.

[0044] To move the cupola from its position on the chassis to its position on the arm, the arm must firstly be released from the tool it is carrying. Then the arm operator uses its movement capacities to bring the assembly interfaces of the arm opposite those of the cupola. The connection of the cupola onto the arm is carried out by this same operator. The cupola is thus released from its mounting on the vehicle. The arm is controlled so as to bring the cupola into the selected position in space for its use. The cupola is thereafter controlled as explained previously.

[0045] To return the cupola to the chassis, the operations are carried out in the reverse manner.

[0046] **FIG. 3** shows an exploded view of the cupola **4** showing its essential parts.

[0047] The base **10** is in the form of a base plate **20** extended by a continuous sidewall **21**. The gripping interface **19** is fixed to the side wall **21** and the communication interface **11** with the chassis is fixed to the plate **20** so as to be able to co-operate with matching means fixed opposite on the vehicle so as to ensure the different controls of the cupola based on the assumption that the cupola is controlled whilst being integral with the vehicle.

[0048] The first cradle **12** that supports the smoke bomb launchers **17** is in the form of a substantially cylindrical rigid base **23** extended on the same side by two parallel wings **24**. The base **23** is, for example, intended to be engaged inside the side wall **21** of the fixed base **10** and is connected to said base by means not shown. The link is able to revolve around 360° along around a shaft D1 thanks to a motor **25** whose purpose is to make the first cradle **12** revolve with respect to the base. A rack and pinion system, not shown, may be used to this end.

[0049] A second cradle **13** is connected to the first cradle **12**. To this end, the two wings **24** support the shaft **14**, not shown here, that is activated in rotation by the motor **15** along shaft D2. The second cradle **13** is fixed to said shaft and supports the observation means **16** on one side and on the other, the offensive devices **18**. These may be constituted by projectile launcher tubes **26** or a machine gun **27**. The tubes **26** may be protected by a cowling **28**.

[0050] Shafts D1 and D2 can be orthogonal or perpendicular so as to ensure a field of observation of the operation ground. By way of illustration, D1 may be a traverse axis and D2 an elevation axis.

[0051] **FIG. 4** shows a phase of operation in which the arm **3** has been separated from the excavator and has been equipped with additional gripping means **30** intended to co-operate with the interface **19**. Once they have been joined, the arm **3** is controlled to unlock the cupola **4** from the vehicle **1**. This may be carried out by simply rotating the base **10** with respect to the vehicle roof. When the unlocking operation has been completed, the arm **3** is controlled in rotation and in elevation until occupying the position shown in **FIG. 5**. In this figure, the vehicle **1** is immobilized and stabilized by the lowering of a shovel **31** to the ground. The arm **3** is then controlled to be able to observe using the cupola **4** a zone located to the fore of the vehicle or else lateral zones. Thus, the vehicle **1** may be hidden and only the uninhabited cupola is in an advanced position likely to be attacked. We can see that when the cupola is fixed to the arm **3**, it is placed in a reverse position to that it occupies on the vehicle.

[0052] Different variants of use of the system according to the invention may be foreseen. We have already mentioned that the cupola may be used directly on the chassis of the vehicle onto which it is mounted or used from the arm of this vehicle by way of alternative. A cupola stored on an inert supporting structure may also be used, or one on another vehicle with the arm of a vehicle itself already equipped with a cupola.

[0053] It goes without saying that the links between the vehicle and the cupola, the signals are transmitted from (or to) the man/machine interface and the display means placed in the user vehicle from (or to) the sensors, the motorizations and the weapons of the cupola by filamentary means (elec-

tric cables, optical fibers, hydraulic piping). By way of a variant, the signals are transmitted from (or to) the man/machine interface and the display means placed in the user vehicle from (or to) the sensors, the motorizations and the weapons of the cupola by radio and/or optical and/or sound means.

[0054] This results in the fact that the operator guiding the cupola may or may not be on board the vehicle carrying the cupola. It goes without saying that several operators may control the cupola on board the vehicle and/or outside of the vehicle. The display is naturally made at the operator's geographical location.

[0055] The cupola may incorporate communication relays, radio-communication means, loud-speakers, microphones, light projectors and miniature drone launchers.

1. An observation and/or firing system intended for an observer housed in a vehicle (1), wherein the vehicle (1) is equipped with elevation means (3) for the observation means (4), said means (4) being supported by a supporting structure, said elevation means (3) being equipped with an interface (19) to provide a power supply and communications with the observation means (4).

2. An observation and/or firing system according to claim 1, wherein the observation means (4) are constituted by a cupola adapted to the supporting structure and able to be removed from it.

3. An observation and/or firing system according to claim 1, wherein the cupola (4) is a component of the usable supporting structure.

4. An observation and/or firing system according to claim 3, wherein the supporting structure is a vehicle (1).

5. An observation and/or firing system according to claim 4, wherein the elevation means (3) are constituted by the maneuvering arm of the vehicle.

6. An observation and/or firing system according to claim 5, wherein the cupola (4) is equipped with control means activated by the observer when the cupola (4) is attached to the elevation means (3) or to the vehicle.

7. An observation and/or firing system according to claim 5, wherein the cupola (4) is equipped with sensors to measure the distance or identify the vehicle or targets.

8. An observation and/or firing system according to claim 7, wherein the sensors are cameras that can be of the day, low level lighting, thermal infrared, light intensifying type, radars, optical or laser range finders, imaging systems, pointed optics detectors or position finders.

9. An observation and/or firing system according to claim 1, wherein the cupola (4) is equipped with offensive devices intended to neutralize, destroy or blind a target.

10. An observation and/or firing system according to claim 9, wherein the offensive devices (18) are constituted by grenade launchers, automatic weapons, cannons or mortars, missile launchers or lasers.

11. An observation and/or firing system according to claim 1, wherein the observation means (4) comprise a base (10) able to be adapted onto the supporting structure (1) and onto the elevation means (3), a first cradle (12) able to move along a first axis (D1) with respect to the supporting structure under the action of motor means (25), a second cradle (13) able to move along a second axis (D2) under the action of a motor (15) with respect to the first cradle, and interfaces to provide power and communications between he structure and the base, the first and second cradle.

12. An observation and/or firing system according to claim 11, wherein the vehicle (11) is equipped with control means for the observation means from the driver's cabin, reception means for the signals transmitted by the observation means and image display means.

13. An observation and/or firing system according to claim 11, wherein the offensive devices (18) and the observation means (16) are fastened to the second cradle (12).

14. An observation and/or firing system according to claim 1, wherein the elevation means (3), the motor means and the observation means (4) are provided with electrical, hydraulic or pneumatic power.

* * * * *